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09/664,937	09/19/2000	Tong Fang	00P7900US	5212

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EXAMINER	
ROSARIO-VASQUEZ, DENNIS	
ART UNIT	**PAPER NUMBER**
2621	

DATE MAILED: 07/30/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/664,937	FANG ET AL.	
	Examiner	Art Unit	
	Dennis Rosario-Vasquez	2621	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *April 4, 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-21* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-21* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *19 September 2000* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Applicant's amendment B was received on 30 April 2004, and has been entered and made of record. Currently, claims 1-21 are pending.

Response to Arguments

2. Regarding claims 1,3,4 and 5 applicant's arguments filed 30 April 2004 Amend B, pages 10,11,13 have been fully considered but they are not persuasive. Amendment B states," Sundar does not teach "determining" a circle upon determining a connectivity of the first and second pair of edge points as claimed in claim 1 (page 11, lines 2-4)." However, Sundar does teach the above limitation of claim 1 of determining a circle using six data points 221-226 that define a circle as mentioned in col. 9, lines 60-61 upon determining a connectivity using a formula "for calculating the center of a circle from points on the circle...(col. 10, lines 21,22)." of the first pair of points 222,225 of fig. 7 and second pair of points 224,223 of fig. 7 of edge points; note that the points 222 and 225 are endpoints for the chord 232 and the points 224 and 223 are endpoints for chord 234 as mentioned in col. 10, lines 43-45. Note that "connectivity" in the specification on page 9, lines 15 and 16 is a" verification procedure [that] can be performed to find the real edge points of a circle." Thus, Sundar teaches a connectivity verification procedure using formula 10 on col. 10, line 24 that uses " extra data points [that] are useful...to eliminate some of the data points that can be determined to be off the circle...(col. 10, lines 8-11)." Therefore, the data points off the circle are not real edge points of a circle.

3. Applicant's arguments, see Amendment B, pages 11,12, filed 30 April 2004, with respect to the rejection(s)of claim(s) 8,9,15,19,20 under Palmquist et al. (US Patent 5,179,419 A) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Sundar et al. (US Patent 6,198,976 B1),Imai et al. (US Patent 5,502,311 A) and Yamagata (US Patent 6,021,222 A).

4. Applicant's arguments, see Amendment B, page 12 filed 30 April 2004, with respect to the rejection(s)of claim(s) 12,13,16 and 17 under Palmqusit et al. and Yamagata have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Sundar et al., Imai (US Patent 5,502,311) and Yamagata.

5. Applicant's arguments, see Amendment B, page 12 filed 30 April 2004, with respect to the rejection(s)of claim(s) 2,10 and 11 under Sundar et al. and Palmquist et al. have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Sundar et al., Imai et al, Yamagata and Huber (US Patent 4,523,188 A).

6. Regarding claim 7, applicant's arguments filed 30 April 2004, Amend B, page 13 have been fully considered but they are not persuasive. Amendment B states, "Sundar does not teach selecting a region of interest manually..." at page 13, line 5, and "Sundar does not teach selecting a region of interest" at line 9, page 13; however Sundar does mention a manual selection from an operator changing the placement of a substrate or the region of interest to obtain better data points that correspond to a

substrate's edge of a perfect circle as mentioned in col. 10, lines 48,49 and col. 11, lines 61-63.

7. Regarding claim 21, applicant's arguments filed 30 April 2004, Amend B, page 13,14 have been fully considered but they are not persuasive. Amend B states," Sundar does not teach determining a circle (Sundar determines a circle using a formula that calculates points on the circle as mentioned in col. 10, lines 21-23; thus points on a circle form a circle.), much less verifying the circle by comparing radiuses...(Sundar compares radiuses from a radius or distance from the center of the calculated circle to the edge of the calculated circle and a radius of a substrate as mentioned in col. 10, lines 50-52; thus a verification of a circle is based upon determining the radiuses for comparison and if the calculated radius is not within a certain length then the circle's data is discarded as mentioned in col. 10, lines 52-54.)" on page 14, lines 1,2.

Claim Rejections - 35 USC § 102

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

9. Claims 1 and 3 are rejected under 35 U.S.C. 102(b) as being anticipated by Sundar (U.S. Patent 6,198,976 B1).

With regard to claim 1, Sundar et al. teaches a method for determining a circle in a region of interest comprising the steps of:

a) Extracting a first pair and a second pair of edge points from a region of interest. The region of interest in Sundar et al. is the substrate 140 in Figure 7. A first pair of edge points consists of data points 223 and 224 and the second pair of edge points consists of data points 222 and 225.

b) Determining an intersection of a first and second line extending perpendicular from a pair of midpoints of the first and second pair of edge points respectively. Sundar et al. calculates the perpendicular bisectors 236, 238 of figure 7, and calculates the intersection of the perpendicular bisectors at the center point 230.

c) Determining a radius from the intersection to any edge point. Sundar et al. states "...the distances [or radius] from the center 230 [of figure 7] to the data points [222-225] of the chords are calculated...(see column 10, lines 50-54)."

e) Determining the circle upon determining a connectivity using a formula that defines a circle of the first pair 222,225 of fig. 7 and second pair of edge points 224,223 of fig. 7. In addition, Sundar does discloses the above limitation of claim 1 of determining a circle using six data points 221-226 that define a circle as mentioned in col. 9, lines 60-61 upon determining a connectivity using a formula "for calculating the center of a circle from points [221-226 of fig. 7] on the circle...(col. 10, lines 21,22)." of the first pair of points 222,225 of fig. 7 and second pair of points 224,223 of fig. 7 of edge points of the circle; note that the points 222 and 225 are endpoints for the chord 232 and the points 224 and 223 are endpoints for chord 234 as mentioned in col. 10, lines 43-45. Note that "connectivity" in the specification on page 9, lines 15 and 16 is a" verification procedure [that] can be performed to find the real edge points of a circle."

Thus, Sundar teaches a connectivity verification procedure using formula 10 on col. 10, line 24 that uses " extra data points [that] are useful...to eliminate some of the data points that can be determined to be off the circle...(col. 10, lines 8-11)." Therefore, the data points off the circle are verified as not real edge points of a circle.

With regard to claim 3, Sundar uses a substrate center-finding system to find a circular substrate as the region of interest (see col. 4, line 51 and col. 5, line 22), and the circular substrate is the dominant feature or object utilized by the center-finding system to find certain characteristics of the circular substrate (see figure 7). Thus, the circle is the dominant feature as called for in claim 3.

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. Claim 8,9,15,19,20 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sundar et al. (US Patent 6,198,976 B1) in view of Imai et al. (US Patent 5,502,311 A) further in view of Yamagata (US Patent 6,021,222 A).

Regarding claim 8, Sundar teaches a method for determining a circle, comprising the steps of:

a) extracting a first pair and a second pair of edge points from a region of interest. The region of interest in Sundar et al. is the substrate 140 in Figure 7. A first pair of edge points consists of data points 223 and 224 and the second pair of edge points consists of data points 222 and 225.

b) determining an intersection of a first and second line extending perpendicular from a pair of midpoints of the first and second pair of edge points respectively. Sundar et al. calculates the perpendicular bisectors 236, 238 of figure 7, and calculates the intersection of the perpendicular bisectors at the center point 230.

c) determining the circle 140 of fig. 7 by verifying a connectivity of adjacent edge points as addressed in claim 1; and

d) verifying the circle 140 of fig. 7 by comparing radiuses between the radius of a substrate and a calculated radius using a formula from at least two edge points 223 and 224 of fig. 7 to the intersection 230 of fig. 7 as mentioned in col. 10, lines 49-54.

Sundar does not teach determining the circle by verifying a connectivity of adjacent edge points in a gradient array of an image, but does suggest using characteristics of a substrate for calibration as mentioned in col. 2, lines 31-34 and col. 5, lines 19-22.

However, Imai et al., in the field of endeavor of detecting plane positions, does teach detecting an image of a substrate for a calibration as mentioned in Imai et al., col. 2, lines 8-14.

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify Sundar's teaching of calibration with Imai et al.'s teaching of calibration, because Imai et al's teaching of calibration "attains a desirable focusing over a wide exposure field...(Imai et al., col. 1, lines 53,54)." Thus "it becomes... [easier]... to design and manufacture a projection system (col. 1, lines 46-49)."

The combination of Sundar and Imai et al. does teach determining the circle by verifying a connectivity of adjacent edge points in an image; however, the combination does not teach the limitation of a gradient array, but does mention using intensities from a photodetector or image as mentioned in Imai et al. col. 46, lines 1-4.

However, Yamagata, in the field of endeavor of detecting circles, does teach image intensity described in terms of image gradients as mentioned in col. 1, lines 59,60 and does teach an array of image gradients as shown in fig. 5B and mentioned in col. 2, lines 7-9.

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the combination of Sundar and Imai et al.'s teaching with Yamagata's teaching of an image gradient, because Yamagata's image gradient detects edges for object or substrate recognition as mentioned in col. 1, lines 12-15 and 47-49.

Regarding claim 9, Sundar teaches from the combination the method of claim 8, further comprising determining a radius or distance from the intersection 230 of fig. 7 as mentioned in col. 10, lines 50-52 to any edge point or data point as mentioned in col. 10, line 45.

Claim 15 has been addressed in claims 8 and 9 except for the limitation of a computer program product comprising a computer usable medium having computer readable program code as shown in fig. 1, num. 105 of Yamagata.

Claim 16 has been addressed in claim 4.

Claim 17 has been addressed in claim 5.

Claims 19 and 20 have been addressed in claim 1.

Claim 21 has been addressed in claim 8.

12. Claims 2 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Sundar et al. (US Patent 6,198,976 B1), Imai et al. (US Patent 5,502,311 A) and Yamagata (US Patent 6,021,222 A) as applied to claims 1and 8 above, and further in view of Huber (US Patent 4,523,188 A).

Regarding claim 10, the combination does not teach the method of claim 8, wherein thte x-axis and the y-axis intersect within the circle. However, the Sundar et al. reference finds the intersection of any 2 chords' perpendicular bisectors within a circle, and does not teach that the x-axis and the y-axis intersect within the circle for finding the intersection of the perpendicular bisector (see col. 10, lines 43-47) and suggests a coordinate system with an x and y axis in fig. 1A that shows the orientation of an object with respect to an x-y axis in the lower right corner and Sundar et al. does mention any 2 chords within a circle can be used to find the perpendicular bisector; therefore the first chord can be horizontal and the second chord can be vertical.

However, Huber, in the field of endeavor of image alignment, teaches a coordinate system that has an x and y-axis intersected within a circle as indicated within figures 1 and 2 (see col. 2, lines 44,45).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use the coordinate system of Huber within the combination of Sundar's circle to determine the position of each of the said horizontal and said vertical chords within Sundar's circle using Huber's coordinate system to locate a spatial relationship of Sundar's and circle to other objects.

Claim 2 has been addressed in claim 10.

Claim 11 has been addressed in claim 3.

13. Claims 4,5,12 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sundar et al. (US Patent 6,198,976 B1), Imai et al. (US Patent 5,502,311 A) and Yamagata (US Patent 6,021,222 A) as applied to claims 1 and 8 above, and further in view of Yamagata (US Patent 6,021,222 A).

With regard to claim 4 calls for the additional steps of:

a) Scanning the image along the x and y axis of the region of interest.

b) Performing a horizontal and vertical gradient along the x and y-axis of the region of interest.

c) Determining whether a local maximum along the gradients match the coordinates for any edge point.

The additional elements of claim 4 above are absent from the Sundar et al. reference, but it's clearly shown in the Yamagata reference. For instance, Yamagata teaches:

Scanning the image along the x and y axis of the region of interest. Yamagata explains "...two orthogonal directions...in a coordinate system describ[es] the scanned image (see column 4, lines 29-31)."

Performing a horizontal and vertical gradient along the x and y-axis of the region of interest. Yamagata states"...the Sobel operator...[calculates] the gradient vector...[and]... uses the "east" (right) and "south" (down) directions as the...directions in a coordinate system (see column 4, lines 22-23,32-34)." Note also Figure 5B where the "SOUTH" operator corresponds to the horizontal gradient and the "EAST" operator corresponds to the vertical gradient.

Determining whether a local maximum along the gradients match the coordinates for any edge point. Yamagata states "...if the difference in intensities is a local maximum.... then the given image pixel is considered an edge pixel (see column 5, lines 15-17)."

Note that Sundar et al. detects the edge points of a circular substrate using a "bank of sensors" which send trigger signals to the controller (see Sundar: col. 6, lines 24-28).

On the other hand, Yamagata detects the edge points of a circle using techniques of digital image processing whereby an image is first transformed into digital data to be processed by a digital computer (see Yamagata: col.1, lines 15 et seq.).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use the edge detecting technique taught by Yamagata in Sundar's system by replacing the "bank of sensors" with digital image processing because Sundar already contemplates the use of digital processing to compute the center coordinate of a circle.

With regard to claim 5,which includes the additional step of searching from each edge of the region of interest inward, Yamagata states,"...the Sobel operator is applied in two orthogonal directions to the intensity values [of pixels]...(see col. 4, lines 26-29)." Note that the Sobel operator uses the "east"(right) and "south"(down) or "north"(up) and the "west" (left) as the orthogonal directions as inward directions of the region of interest or document (see col. 2, lines 44-45, col. 4, lines 30-31,42,43 and figure 5B).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use the teachings of Yamagata to use the Sobel operator to define edge features of various shapes.

Claim 12 has been addressed in claim 4.

Claim 13 has been addressed in claim 5.

14. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sundar et al. (US Patent 6,198,976 B1) as applied to claim1 above, and further in view of Sundar et al.

Claim 7 requires a manual procedure for selecting the region of interest. Sundar et al. teaches," Based on positional feedback...the controller can determine the...center of a substrate [or region of interest as the substrate] (see col. 6, lines 31-

35). ").

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use the teachings Sundar et al., because if Sundar et al.'s automatic feedback procedure was removed, a manual procedure for finding the region of interest will be used by default. Moreover, a selection done by machine can obviously be done manually.

Additionally, Sundar does mention a manual selection from an operator changing the placement of a substrate or the region of interest to obtain better data points that correspond to a substrate's edge of a perfect circle as mentioned in col. 10, lines 48,49 and col. 11, lines 61-63.

Allowable Subject Matter

15. Claims 6,14 and 18 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

16. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Hongo (JP 60029878 A) is pertinent as teaching a method of determining a circle using points on the edge and inside the circle as shown in fig. 12 and connectivity analysis of points.

Hayes (US Patent 6,724,947 B1) is pertinent as teaching a method of fitting a calculated circle with an object as mentioned in the abstact.

17. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

18. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dennis Rosario-Vasquez whose telephone number is 703-305-5431. The examiner can normally be reached on 9-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo Boudreau can be reached on 703-305-4706. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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